SYSTEMS, SCIENCE AND SOFTWARE

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ENERGY DEPOSITION IN LASERS

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Summary

The contract has been continued to provide an improved version of the ZAP code. The following items have been added to the code:

1. Multi-frequency calculation,
2. Bodies of revolution,
3. Cylindrical surface source,
4. Geometry debug facility.

The addition of a helix geometry has been partially completed.

Multifrequency Calculation

The ZAP code has been modified to perform the calculations simultaneously for many rays of different wavelengths. Each material may have its own absorption coefficient for each wavelength. The absorption coefficients are specified as a function of the wavelength by a specific subroutine for each material. Each boundary may have a wavelength and angle dependent reflection coefficient. A subroutine for each source will specify the relative weight of the rays as a function of the wavelength.

The programming and debugging have been completed.

Helix Geometry

A considerable amount of work has been performed in specifying the geometrical routines for calculating the intersection with and reflection from a helix. The primary problem is that in general there may be an infinite number of intersections between a straight line and a helix. A large amount of computer time may be wasted by calculating any but the nearest intersections as the solution is transcendental. The current method only analyzes the intersections with the two "nearest" turns in the helix, thus saving many unnecessary calculations.

Left or right handed cylindrical helices with constant pitch and axis parallel to the z-axis may be specified.

The analysis is complete and the programming is partially completed.

Bodies of Revolution

The geometry and input routines of the ZAP code have been augmented to allow the specification of the following bodies of revolution:

a. Sphere
b. Ellipsoid
c. Paraboloid
d. Hyperboloid
e. Cone

In all cases the axis of revolution must be parallel to the z-axis.

The programming and debugging have been completed.

Surface Sources

The ZAP code originally allowed only isotropic volume sources. As some types of lamps may be more accurately defined as surface sources, the code has been modified to allow the specification of cylindrical surface sources with the axis of the cylinder parallel to the z-axis. The source distribution is specified relative to the cylinder axis and the surface normal at the selected source point. The direction of the source rays may be specified inward or outward.

The programming and debugging have been completed.

Geometric Debug Facility

It is unfortunately not impossible to make mistakes in the geometrical input, such as specifying an incorrect dimension, a wrong material number or the opposite sign of a boundary. Such mistakes may frequently be spotted by a careful analysis of the results, but sometimes they generate acceptable nonsense.

The geometric debug facility allows the user to check for such mistakes by specifying a plot of all boundary intersections with an arbitrary plane of arbitrary size. Any number of such planes may be requested.

The plots are generated on the printer. The width is always equal to the width of the paper, the length is scaled to that width. In this manner the most minute geometrical details may be displayed by specifying a small plane.

The lines formed by the intersections of boundaries and the arbitrary plane are displayed as blanks, while the area between lines is printed solid with the material number. In this manner both the boundary locations and the materials assigned to segments may be displayed in one plot.

The programming and debugging have been completed.